

SEQUENCE LISTING

<110> COSTA E SILVA, OSWALDO DA
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VAN THIELEN, NOCHA
CHEN, ROUYING

<120> GTP BINDING STRESS-RELATED PROTEINS AND METHODS OF USE
IN PLANTS

<130> 16313-0039

<140> 09/828,310

<141> 2001-04-06

<150> 60/196,001

<151> 2000-04-07

<160> 50

<170> PatentIn Ver. 2.1

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<211> 805

<212> DNA

<213> *Physcomitrella patens*

<400> 1

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agcattgtcg agaccagaaa acaggatttt ggccctcttc tgccacagcc ctatgctcgc 720
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<210> 2

<211> 671

<212> DNA

<213> *Physcomitrella patens*

<400> 2

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ccatcgcttg cctctctgac aaccctgacc tcactctctc gtcgtctcgc gacaagagca 240
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cggggctcgt ggacggggacc ttgcgtttgt gggatttgaa caccggaact accaccggc 420
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tgactgctaa ccctatcatt gtgtccggtg ggtgggacaa ggttgtcaag gtgtggaacc 660
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671

<210> 3

<211> 749

<212> DNA

<213> *Physcomitrella patens*

<400> 3

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gagaccactc gactattgcc accatccacg tccactttat gttccaagta ctacaaaggg 180
gaagttctcc tgatcggatg ggcttgctg aatcagaaac tcgtccctcc agttgtcaag 240
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749

<210> 4

<211> 815

<212> DNA

<213> *Physcomitrella patens*

<220>

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<223> a, t, c, g, other or unknown

<400> 4

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taccagcccc atcttatagc tccggagcaa gggtacaggc ggctaattga aagttcgctg 180
caatttttca ggggcccagc ggaggcagta gtggatgcag taagtcactc tgttgcaacg 240
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tttctagtca cgacattctg catacttacc agtagcacag ggttcggctg attcgtgatt 360
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815

<210> 5

<211> 490

<212> DNA

<213> *Physcomitrella patens*

<400> 5

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aaccggatcg gaagctcctg cggaaggagc tgatgagcct accaaggctg gcgaggagga 180
ggacacaggt gctcaaatcg cgcctatcgt aacattacag gaagttgctg ttagcactgg 240
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aggaacccag tggaaagagc ggggcgttgg ccaagttaag atattagagc ataagactac 360
cagaaaggtc cgattgctca tgcgacaaaa tcggaccctg aagatctgtg ctaatcacat 420
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<210> 6

<211> 667

<212> DNA

<213> *Physcomitrella patens*

<400> 6

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atgctggcaa gactactctt ctgcacatgc tcaaggatga gaaactgggg caacatcaac 180
caacgcagta tccaacgtca gaggagtga gtatcaacag agtgaagttc aaagcattcg 240
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agattgatat cccgtacgct tcttctgaag acgagttgcy gttcacactt ggggtgacca 480
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tcatgtgcag tattgtgcgc aaaatggggg acggtgaagg tttcaagtgg atgaccagtt 600
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667

<210> 7

<211> 1045

<212> DNA

<213> *Physcomitrella patens*

<400> 7

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1045

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 <212> DNA
 <213> *Physcomitrella patens*

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<210> 9
 <211> 2119
 <212> DNA
 <213> *Physcomitrella patens*

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<210> 10

<211> 883

<212> DNA

<213> *Physcomitrella patens*

<400> 10

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<210> 11

<211> 192

<212> PRT

<213> *Physcomitrella patens*

<400> 11

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 Lys Thr Thr Leu Leu His Met Leu Lys Asp Glu Lys Leu Gly Gln His
 35 40 45
 Gln Pro Thr Gln Tyr Pro Thr Ser Glu Glu Leu Ser Ile Asn Arg Val
 50 55 60
 Lys Phe Lys Ala Phe Asp Leu Gly Gly His Thr Ile Ala Arg Arg Val
 65 70 75 80
 Trp Arg Asp Tyr Tyr Ala Lys Val Asp Ala Ile Val Tyr Leu Val Asp
 85 90 95
 Ala Val Asp Arg Glu Arg Phe Ala Glu Ser Lys Lys Glu Leu Asp Ser
 100 105 110

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Leu Leu Ser Asp Asp Ser Leu Ser Gln Val Pro Val Leu Val Leu Gly
115 120 125

Asn Lys Ile Asp Ile Pro Tyr Ala Ser Ser Glu Asp Glu Leu Arg Phe
130 135 140

Thr Leu Gly Leu Thr Met Thr Thr Gly Lys Gly Thr Val Asn Leu Gly
145 150 155 160

Asp Ser Asn Ile Arg Pro Ile Glu Val Phe Met Cys Ser Ile Val Arg
165 170 175

Lys Met Gly Tyr Gly Glu Gly Phe Lys Trp Met Thr Gln Tyr Ile Lys
180 185 190

<210> 12

<211> 316

<212> PRT

<213> *Physcomitrella patens*

<400> 12

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Ser Ser Ser Arg Asp Lys Ser Ile Ile Val Trp Thr Leu Thr Arg Glu
35 40 45

Glu Gly Asn Tyr Gly Val Ala Arg Arg Arg Leu Thr Gly His Ala His
50 55 60

Phe Val Gln Asp Val Val Ile Ser Ser Asp Gly Gln Phe Ala Leu Ser
65 70 75 80

Gly Ser Trp Asp Gly Thr Leu Arg Leu Trp Asp Leu Asn Thr Gly Thr
85 90 95

Thr Thr Arg Arg Phe Ile Gly His Thr Lys Asp Val Leu Ser Val Ala
100 105 110

Phe Ser Val Asp Asn Arg Gln Ile Val Ser Gly Ser Arg Asp Lys Thr
115 120 125

Ile Lys Leu Trp Asn Thr Leu Gly Glu Cys Lys Tyr Thr Ile Gln Asp
130 135 140

Val Asp Ala His Thr Gly Trp Val Ser Cys Val Arg Phe Ser Pro Val
145 150 155 160

Thr Ala Asn Pro Ile Ile Val Ser Gly Gly Trp Asp Lys Val Val Lys
165 170 175

Val Trp Asn Leu Thr Asn Cys Lys Ile Arg Ser Asn Leu Val Gly His
180 185 190

Thr Gly Tyr Val Asn Thr Val Thr Val Ser Pro Asp Gly Ser Leu Cys
 195 200 205

Ala Ser Gly Gly Lys Asp Gly Val Ala Met Leu Trp Asp Leu Ser Glu
 210 215 220

Gly Lys Arg Leu Tyr Ser Leu Asp Ala Gly Asp Ile Ile His Ser Leu
 225 230 235 240

Cys Phe Ser Pro Asn Arg Tyr Trp Leu Cys Ala Ala Thr Gln Ser Cys
 245 250 255

Ile Lys Ile Trp Asp Leu Glu Ser Lys Ser Ile Val Asp Glu Leu Arg
 260 265 270

Pro Glu Phe Thr Phe Val Ser Lys Lys Ala Gln Ile Pro Tyr Cys Val
 275 280 285

Ser Leu Asn Trp Ser Ala Asp Gly Ser Thr Leu Phe Ser Gly Tyr Thr
 290 295 300

Asp Gly His Ile Arg Val Trp Ala Val Gly Arg Ala
 305 310 315

<210> 13

<211> 206

<212> PRT

<213> Physcomitrella patens

<400> 13

Met Ser Ala Arg Lys Arg Thr Leu Leu Lys Val Ile Ile Leu Gly Asp
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Ser Gly Val Gly Lys Thr Ser Leu Met Asn Gln Tyr Val Asn Lys Lys
 20 25 30

Phe Ser Asn Gln Tyr Lys Ala Thr Ile Gly Ala Asp Phe Leu Thr Lys
 35 40 45

Glu Val Gln Val Glu Asp Arg Leu Val Thr Met Gln Ile Trp Asp Thr
 50 55 60

Ala Gly Gln Glu Arg Phe Gln Ser Leu Gly Val Ala Phe Tyr Arg Gly
 65 70 75 80

Ala Asp Cys Cys Val Leu Val Tyr Asp Val Asn Val Met Lys Ser Phe
 85 90 95

Asp Asn Leu Asp Asn Trp Arg Asp Glu Phe Leu Ile Gln Ala Ser Pro
 100 105 110

Ser Asp Gln Glu Asn Phe Pro Phe Val Val Leu Gly Asn Lys Val Asp
 115 120 125

Val Asp Gly Gly Asn Ser Arg Val Val Ser Glu Lys Lys Ala Lys Ala
 130 135 140

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Trp Cys Ala Ala Lys Gly Gly Ile Pro Tyr Phe Glu Thr Ser Ala Lys
145 150 155 160

Glu Asp Phe Asn Val Asp Ala Ala Phe Gln Cys Ile Ala Lys Asn Ala
165 170 175

Leu Lys Asn Glu Thr Glu Glu Glu Ile Tyr Leu Pro Asp Thr Ile Asp
180 185 190

Val Asn Ala Ser Arg Pro Gln Lys Thr Ser Gly Cys Glu Cys
195 200 205

<210> 14

<211> 609

<212> PRT

<213> Physcomitrella patens

<400> 14

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20 25 30

Ala Leu Pro Ser Val Ala Val Val Gly Gly Gln Ser Ser Gly Lys Ser
35 40 45

Ser Val Leu Glu Ser Ile Val Gly Arg Asp Phe Leu Pro Arg Gly Ser
50 55 60

Gly Ile Val Thr Arg Arg Pro Leu Val Leu Gln Leu His Lys Thr Asp
65 70 75 80

Glu Gly Thr Gln Glu Tyr Ala Glu Phe Leu His Met Pro Lys Lys Arg
85 90 95

Phe Thr Asp Phe Ala Ala Val Arg Lys Glu Ile Ser Asp Glu Thr Asp
100 105 110

Arg Met Thr Gly Arg Gly Lys Gly Ile Ser Val Val Pro Ile Gln Leu
115 120 125

Ser Val Tyr Ser Pro Asn Val Val Asn Leu Thr Leu Ile Asp Leu Pro
130 135 140

Gly Leu Thr Lys Ile Ala Val Asp Gly Gln Ser Asp Ser Ile Val Gln
145 150 155 160

Asp Ile Glu Asn Met Val Arg Ser Tyr Ile Glu Lys Gln Asn Ser Ile
165 170 175

Ile Leu Ala Val Ser Pro Ala Asn Gln Asp Ile Ala Thr Ser Asp Ala
180 185 190

Met Lys Ile Ala Arg Glu Val Asp Pro Thr Gly Glu Arg Thr Phe Gly
195 200 205

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Val Leu Thr Lys Leu Asp Leu Met Asp Lys Gly Thr Asn Ala Leu Asp
 210 215 220

Val Leu Glu Gly Arg Ser Tyr Arg Leu Gln His Pro Trp Val Gly Val
 225 230 235 240

Val Asn Arg Ser Gln Gln Asp Ile Asn Lys Glu Val Asn Met Ile Ala
 245 250 255

Ala Arg Arg Arg Glu Arg Glu Tyr Phe Ala Thr Ser Gln Asp Tyr Gly
 260 265 270

His Leu Ala Ser Lys Met Gly Ser Glu Tyr Leu Gly Lys Val Leu Ser
 275 280 285

Lys His Leu Glu Ala Val Ile Lys Ser Arg Ile Pro Ser Ile Gln Ala
 290 295 300

Met Ile Asn Lys Ser Ile Asp Glu Ile Glu Met Glu Leu Asn Gln Ile
 305 310 315 320

Gly Arg Pro Leu Ala Asn Asp Ala Gly Ala Gln Leu Tyr Thr Ile Leu
 325 330 335

Glu Leu Cys Arg Ala Phe Asp Arg Ile Phe Lys Asp His Leu Asp Gly
 340 345 350

Ala Arg Pro Gly Gly Asp Lys Ile Tyr Ala Val Phe Asp Asn Gln Leu
 355 360 365

Pro Ala Ala Leu Lys Lys Leu Pro Phe Asp Lys His Leu Ser Gly Gln
 370 375 380

Asn Val Arg Arg Ile Val Ser Glu Ala Asp Gly Tyr Gln Pro His Leu
 385 390 395 400

Ile Ala Pro Glu Gln Gly Tyr Arg Arg Leu Ile Glu Ser Ser Leu Gln
 405 410 415

Phe Phe Lys Gly Pro Ala Glu Ala Val Val Asp Ala Val His Phe Ile
 420 425 430

Leu Arg Asp Leu Val Arg Lys Ser Ile Gly Glu Cys Ser Glu Leu Lys
 435 440 445

Arg Phe Pro Ser Leu Gln Ala Glu Ile Ala Gln Ala Ala Ile Glu Ser
 450 455 460

Leu Glu Arg Met Arg Asp Glu Ser Lys Lys Thr Thr Leu Arg Leu Val
 465 470 475 480

Asp Met Glu Ser Ser Tyr Leu Thr Val Asp Phe Phe Arg Lys Leu Pro
 485 490 495

Gln Glu Ile Glu Lys Gly Gly Asn Ala Ala Ala Ala Ala Asn Asp Arg
 500 505 510

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Tyr Thr Asp Asn His Leu Arg Arg Ile Gly Ser Asn Val Ala Ala Tyr
515 520 525

Val Gly Met Val Cys Asp Gln Leu Arg Asn Ser Leu Pro Lys Ala Ala
530 535 540

Val His Cys Gln Val Arg Glu Ala Lys Arg Ser Leu Met Asp His Phe
545 550 555 560

Tyr Thr Gln Ile Gly Lys Arg Glu Gly Lys Gln Leu Ser Ala Met Leu
565 570 575

Asp Glu Asp Pro Ala Leu Met Glu Arg Arg Val Gln Leu Ser Lys Arg
580 585 590

Leu Glu Leu Tyr Lys Gln Ala Arg Asp Glu Ile Asp Ser Val Ala Trp
595 600 605

Lys

<210> 15

<211> 216

<212> PRT

<213> Physcomitrella patens

<400> 15

Met Ala Ala Asp Asp Glu Lys Gln Ala Arg Glu Val Glu Glu Thr Thr
1 5 10 15

Gly Ser Glu Ala Pro Ala Glu Gly Ala Asp Glu Pro Thr Lys Ala Gly
20 25 30

Glu Glu Glu Asp Thr Gly Ala Gln Ile Ala Pro Ile Val Thr Leu Gln
35 40 45

Glu Val Ala Val Ser Thr Gly Glu Glu Asp Glu Asp Val Leu Ile Asp
50 55 60

Met Lys Ala Lys Leu Tyr Arg Phe Asp Lys Glu Gly Thr Gln Trp Lys
65 70 75 80

Glu Arg Gly Val Gly Gln Val Lys Ile Leu Glu His Lys Thr Thr Arg
85 90 95

Lys Val Arg Leu Leu Met Arg Gln Asn Arg Thr Leu Lys Ile Cys Ala
100 105 110

Asn His Met Val Thr Ala Ala Thr Gln Leu Gln Glu His Ala Gly Ser
115 120 125

Asp Lys Ser Trp Ile Trp His Ala Arg Asp Tyr Ser Asp Gly Glu Leu
130 135 140

Lys Glu Glu Leu Phe Cys Met Arg Phe Gly Ser Val Glu Ser Ala Gln
145 150 155 160

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<210> 20
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<220>
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<210> 21
<211> 34
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Primer

<400> 21
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<210> 22
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<220>
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<210> 23
<211> 33
<212> DNA
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<210> 24
<211> 25
<212> DNA
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 24

cacaactgcc ctggctccaa aatca

25

<210> 25

<211> 32

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 25

atcccgggca ggagattgga gaatcagtct gc

32

<210> 26

<211> 34

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 26

gcgagctcga ccctggcatt tcccatcgca gcaa

34

<210> 27

<211> 25

<212> DNA

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Primer

<400> 27

tactgcatcc actactgcct ccgct

25

<210> 28

<211> 33

<212> DNA

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Primer

<400> 28

atcccgggca cgctccacc ctcttgggtc aca

33

<210> 29

<211> 33

<212> DNA

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Primer

<400> 29

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33

<210> 30

<211> 25

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 30

tgtcctcctc ctgccagcc ttggt

25

<210> 31

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<212> DNA

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<400> 31

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33

<210> 32

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<212> DNA

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<400> 32

gcgagctcgc aactggcgta cttattaaca cta

33

<210> 33

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<212> DNA

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<223> Description of Artificial Sequence: Primer

<400> 33

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<210> 34
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<210> 35
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 <212> DNA
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<220>
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<210> 36
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<210> 37
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<210> 38
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<210> 39
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<210> 40
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<210> 41
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<210> 42
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<210> 43
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<210> 44
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<220>
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<210> 45
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<210> 46
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gcgagctcga ccctggcatt tcccatcgca gcaa 34

<210> 47
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<400> 47
ggcacacagg agtacgcaga gtttc 25

<210> 48
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<223> Description of Artificial Sequence: Primer

<400> 48

cgctctctgc gtcttgctgc tatcatg

27

<210> 49

<211> 33

<212> DNA

<213> Artificial Sequence

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<400> 49

atccccgggcg tccaccctca accagattgg tgc

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<210> 50

<211> 33

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<223> Description of Artificial Sequence: Primer

<400> 50

gcgagctcgc aactggcgta cttattaaca cta

33